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First Named Inventor	Weisgerber, Scott T.
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Examiner Name	Grant, Robert J.
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ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
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Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Cichosz & Cichosz, PLLC		
Signature	St Mahan		
Printed name	Stephen T. Mahan		
Date	30 June 2006	Reg. No.	56,565

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Scott T. WEISGERBER
Serial No.:	10/779,481
Filed:	February 14, 2004
For:	ENERGY STORAGE SYSTEM STATE OF CHARGE DIAGNOSTIC
Group Art Unit:	2838
Examiner:	Robert. J. Grant
Application Docket No.:	GP-304122

ON APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

(41 C.F.R. §41.37)

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir,

Applicant, in the above-identified patent application, appeals the final rejection of claims 1-3 and 7-9, and the objection to claim 4, as set forth in the final Office Action mailed 01/12/2006.

I. Real Party in Interest

General Motors Corporation, a Delaware corporation with offices in Detroit, Michigan is the real party in interest in this case, having been assigned the invention.

II. Related Appeals and Interferences

There are no related appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

A Pre-Appeal Brief Request for Review was filed on 04/11/2006. The Panel Decision, which was mailed 06/02/2006, was to proceed to the Board of Patent Appeals and Interferences.

III. Status of Claims

Total number of claims in the application: 9

Status of the Claims:

Claims Pending:	Claims 1 – 9
Claims Allowed:	Claims 5 and 6
Claims Rejected:	Claims 1, 2, 3, 7, 8, 9
Claims Objected to:	Claim 4
Claims on Appeal:	Claims 1, 2, 3, 4, 7, 8, 9

IV. Status of Amendments

No amendments to the application have been filed subsequent to final rejection. Claims 1-9 stand as originally filed. A copy of the claims at issue is attached as the Claims Appendix.

V. Summary of Claimed Subject Matter

The claimed subject matter of the invention is a method for monitoring a state-of-charge (SOC) of an energy storage system (e.g., a battery) to diagnose a critical SOC thereof. An application of the method comprises energy storage systems for hybrid electric vehicles. The diagnostic method closely monitors present SOC in regions of extreme SOC, and provides an opportunity for the state of charge to recover to acceptable levels. When an extreme SOC – either extremely high or extremely low – is detected, a determination is made whether a battery operating point, comprising a combination of SOC and battery power flow into or out of the battery, defines an incipient threat to battery condition, i.e., can lead to damage of the battery. If such a threat is identified, then a diagnostic monitoring of the SOC is invoked. The diagnostic monitoring provides for a duration of allowable operation within the extreme SOC that varies with how extreme the SOC is. The diagnostic routine essentially allows for lesser duration of operation when the SOC is more extreme and longer duration of operation when the SOC is not so extreme. And, if the SOC is trending toward improvement, the diagnostic monitoring recognizes that the battery power flow is improving the SOC and effectively extends the duration.

VI. Grounds of Rejection to be Reviewed on Appeal

Claims 1-3 and 7-9 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Koo, USPN 6,841,972 B2, issued Jan. 11, 2005 (*Koo*). Claim 4 was objected to as being dependent upon rejected base claim 1, but was indicated as allowable if rewritten in independent form including all of the limitations of claim 1.[1]

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[1] Objection recited in first Office Action on the merits mailed 8/10/2005 but not specifically reiterated in the final Office Action mailed 1/12/2006.

VII. Argument

A. Introduction

The Office Action stated that claims 1-3 and 7-9 were rejected, under 35 U.S.C. § 102(e) as being anticipated by *Koo*.

B. Statement of the Law

Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1458 (Fed. Cir. 1984).

C. Response and Argument

The applicant respectfully asserts that the single prior art reference applied against the claims fails to anticipate in as much as it does not disclose of each and every element of the claimed invention, arranged as in the claim..

The Office Action rejected claims 1-3 and 7-9 under 35 U.S.C. § 102(e) as being anticipated by *Koo*. *Koo* essentially discloses a method for resetting a battery state of charge (actually state of health (*See,* Col. 4, Lines 35-46) to reduce accumulated errors. It does so with, for example with respect to Fig. 2 and discharge operation, steps to compare discharge current to a threshold (S205), determining if there is a change in the one of the battery modules having the minimum voltage (S206) and, if not, then comparing a theoretical discharge voltage (presumably of the minimum module) against the voltage of the minimum module and additional steps dependent upon the comparison.

C.1 Arguments with regard to claim 1

The Office Action rejected claim 1 under 35 U.S.C. § 102(e) as being anticipated by *Koo*. The Office Action equated each of the elements of claim 1 to elements found in *Koo*. Applicant disagrees with the Office Action analysis, and offers the following which distinguishes claim 1 over *Koo*.

Claim 1 sets forth:

> 1. Method for diagnosing a critical state of charge condition of an energy storage system, comprising:
> obtaining power flow and state of charge for the energy storage system;
> determining if the combination of power flow and state of charge meet predetermined criteria;
> if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration.

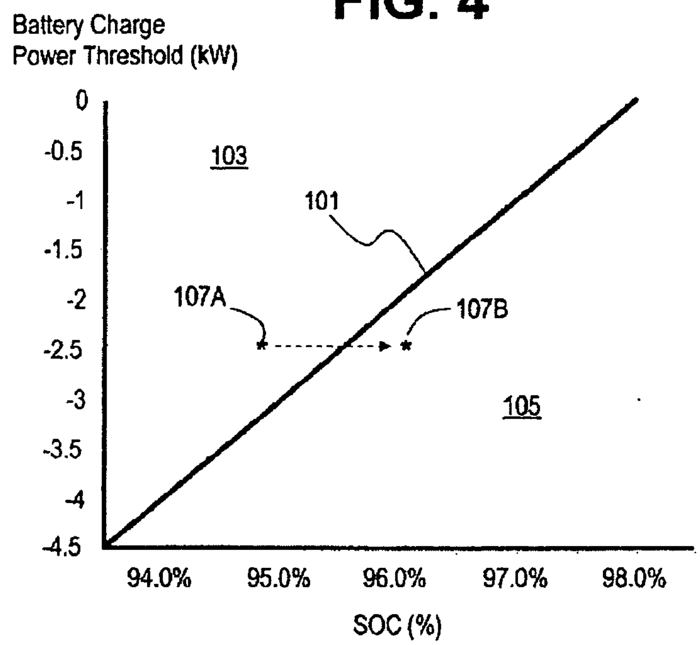
C.1.i <u>*Koo* fails to teach or describe the element of "obtaining power flow and state of charge for the energy storage system"</u>

The Office Action references *Koo* at Col. 5, lines 17-22 to argue that "a present discharge current" anticipates obtaining <u>power flow</u> <u>and</u> <u>state of charge</u> for the energy storage system of claim 1. This is clearly in error.

The "present discharge current" of *Koo* is a monitored parameter measured in amps (A) (*See,* Col. 5, Line 20), whereas the instant invention describes the <u>power flow</u> measured in kilowatts (kW), and the <u>state of charge</u> measured in percent (%). Furthermore, the power flow and state of charge are descriptive of an operating point of the energy storage device, as defined throughout the specification (*See, e.g.*, Paras. 0044, 0045).

Operating points of the instant invention can be plotted as shown in Figs. 4 and 5, with Fig. 4 reproduced in its entirety hereinbelow:

FIG. 4



Referring to Fig. 4, the power flow is plotted on the Y-axis (kW) and the state of charge (%), is plotted on the X-axis. Line 101 delineates regions 103 and 105. Operating points defined by power flow and SOC combinations within region 103 are generally not considered to define an incipient threat to battery condition, e.g., point 107A. Operating points defined by power flow and SOC combinations within region 105 are considered to define an incipient threat to battery condition. (*See,* Para. 0044).

Referring again to Fig. 4, the features designated as 107A and 107B comprise operating points which readily distinguish the present invention from *Koo*. Features 107A and 107B are different, distinguishable in that they occur at different values for SOC, but occur at the same power flow.

Therefore, the element of "obtaining power flow and state of charge for the energy storage system" is neither taught nor described by the "discharge current" of *Koo*. This alone distinguishes claim 1 over *Koo*.

C.1.ii ***Koo*** **fails to teach or describe the element of "determining if the combination of power flow and state of charge meet predetermined criteria".**

The Office Action references *Koo* at Col. 5, lines 46-53 to argue that "the theoretical discharge voltage is determined to be greater than the minimum discharge voltage" anticipates determining if the combination of power flow and state of charge meet predetermined criteria of claim 1. This is clearly in error.

Firstly, the element of "determining if the combination of power flow and state of charge meet predetermined criteria" clearly and unambiguously refers to the previous element in the claim. However, the Office Action attempts to redefine the previous element as being a "discharge voltage", whereas it had previously defined the previous element as being a "discharge current".

Secondly, the power flow and state of charge are descriptive of an operating point of the energy storage device, as described hereinabove, and shown with reference again to Fig. 4, above. Furthermore, the referenced "predetermined criteria" refer to predetermined criteria related to the combination of power flow and state of charge (for example thresholds for each of power flow and state of charge. (*See, e.g.*, Para. 0047)).

The single dimensional "discharge voltage" can not anticipate the two-dimensional elements of power flow and state of charge, for the same reasons as argued with regard to the first element above.

Therefore, the element of "determining if the combination of power flow and state of charge meet predetermined criteria" is neither taught nor described by the disclosure of *Koo*. This alone distinguishes claim 1 over *Koo*.

C.1.iii ***Koo*** **fails to teach or describe the element of "if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration".**

The Office Action references Col 5, Lines 54-60 to argue that "[i]f . . . it is determined that the theoretical discharge voltage does remain greater than the minimum discharge voltage for the predetermined period of time, the battery management system sets a very low SOC warning" anticipates the element "if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration". This is clearly in error.

Firstly, the instant invention defines the term "state of charge" as "[s]tate of charge (SOC) is defined generally as the ratio of the residual charge in a battery or battery pack relative to full charge capacity" (*See,* Para. 0007). In direct contrast to this definition, *Koo* specifically and unambiguously states that the term "state of charge" used therein is defined differently from the typical definition for state of charge (SOC), as follows:

> "[T]he state of charge (SOC) of the battery 30 is typically defined as the ratio of the remaining capacity of the battery to its fully-charged capacity. However for purposes of the present invention, the SOC is defined as the ratio of the amount of currently-available capacity of the battery to the amount of total-available capacity. In other words, the SOC indicates a state-of-health (SOH) of the battery, which is generally defined as the ability to perform a specified task. The SOH of the battery reflects various factors of the battery, such as temperature change, high-rate discharge efficiency, and decrease of the battery capacity caused by deterioration of the battery." (*See,* Col. 4, Lines 35 – 46).

Therefore, the SOC of *Koo* can not anticipate claim 1.

Secondly, the claim element recites "if the predetermined criteria are met", referring unambiguously to predetermined criteria related to the combination of power flow and state of charge of the previous elements. As previously argued, the "theoretical discharge voltage" of *Koo* fails to disclose the combination of power flow and state of charge.

Thirdly, *Koo's* disclosure at column 5, lines 54-60 relates to a simple timer that is active when a theoretical discharge voltage exceeds voltage of the minimum voltage module (*See, e.g.,* Fig. 2, S209). The simple timer and result of *Koo* neither teaches nor describes "the <u>state of charge</u> is outside of a

predetermined region of state of charge for a predetermined duration." *Koo* discloses no reliance upon a state of charge being outside of a predetermined region.

Therefore, the element of "if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration" is neither taught nor described by *Koo*. These arguments related to this element of claim 1 also distinguish claim 1 over *Koo*.

C.2 Arguments with regard to claim 2

The Office Action rejected claim 2 under 35 U.S.C. § 102(e) as being anticipated by *Koo*. The examiner equated each of the elements of claim 2 to elements found in *Koo*. Applicant disagrees with the examiner's analysis, and offers the following which distinguishes claim 2 over *Koo*.

Claim 2 sets forth:

> 2. Method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 1 wherein the predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge.

Koo fails to teach or describe the element of "predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge".

The Office Action references *Koo* at Col. 7, lines 13-17 to argue that "if the theoretical charge voltage is not less than the maximum charge voltage, the battery management system clears a very high SOC warning. . ." anticipates "predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge" of the instant invention. This is clearly in error.

Firstly, the teaching of *Koo* is in reference to a method for resetting the SOC of a battery during a charge mode of the battery (*See*, Col 6, Lines 20-23), and, "if the theoretical charge voltage is not less than the maximum charge voltage, the battery management system clears a very high SOC warning (S314), and clears an error counter for a very high SOC (HHighErrorSOCTime)(S315)".

In contrast, the element of claims 2 of "the predetermined criteria characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge" is described with reference to Fig. 4, above, and in Para. 0044 of the specification, wherein it is stated:

> Operation outside of predetermined SOC limits, corresponding to relatively high and low SOCs, will be allowed to continue normally provided that the power flows are actually improving the SOC or the power flow magnitude is not deemed an incipient threat to battery condition at the present SOC. . . .Line 101 delineates regions 103 and 105. Operating points defined by power flow and SOC combinations within region 103 are generally not considered to define an incipient threat to battery condition, e.g. point 107A. Generally, however, such continued charging power flows would trend SOC higher and thus the operating point would eventually be in region 105, e.g. point 107B. Such operating points . . .within region 105 are . . . considered to define an incipient threat to battery condition. As can be seen by following line 101, as SOC trends higher, e.g. further outside of the predetermined SOC limits, the magnitude of battery charge power required to define an incipient threat to battery condition decreases. In other words, in the case of high SOCs, the higher the SOC, the less recharging is tolerated. (emphasis added)

Thus, claim 2 describes less charging power flow with increasing state of charge, whereas *Koo* seems to be concerned with measurement of elapsed time during which the SOC is in a Very High state.

Therefore, *Koo* neither teaches nor describes the element "predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge" as claimed. This alone distinguishes claim 2 over *Koo*.

Secondly, the predetermined criteria of the instant invention refer unambiguously to predetermined criteria related to the combination of power flow and state of charge of the previous elements. As previously set forth, the

"theoretical discharge voltage" of *Koo* is not the combination of power flow and state of charge of the claims, which also distinguishes claim 2 over *Koo*.

C.3 Arguments with regard to claims 3 and 4

Claims 3 and 4 are ultimately dependent upon claim 1, and are therefore allowable for the same reasons set forth for claim 1.

C.4 Arguments with regard to claim 7

The Office Action rejected claim 7 under 35 U.S.C. § 102(e) as being anticipated by *Koo*. The Office Action equated each of the elements of claim 7 to elements found in *Koo*. Applicant disagrees with the Office Action analysis, and offers the following which distinguishes claim 7 over *Koo*.

Claim 7 sets forth:

> 7. (original) Method for diagnosing a critical state of charge condition of an energy storage system, comprising:
>
> within a predefined extreme range of state of charge, providing a plurality of state of charge thresholds and a corresponding plurality of unique increment values, said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge;
>
> periodically obtaining state of charge;
>
> for so long as state of charge is outside of the predefined range of non-extreme state of charge
>
> comparing the state of charge to the state of charge thresholds and selecting one of said increments in accord with the comparison;
>
> incrementing a counter with the selected increment;
>
> comparing the counter to a counter limit; and
>
> providing an indication of a critical state of charge condition if said counter exceeds said counter limit.

<u>*Koo* fails to teach or describe the element of "within a predefined extreme range of state of charge, providing a plurality of state of charge thresholds and a corresponding plurality of unique increment values, said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge".</u>

The examiner references Fig. 4 of *Koo* to argue that the various classifications of the SOC made (*See,* Col. 4, Lines 47-45) by *Koo* anticipate "a predefined extreme range of state of charge, providing a plurality of state of charge thresholds and a corresponding plurality of unique increment values, said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge" of the instant invention. This is clearly in error.

Firstly, the instant invention describes "providing a plurality of state of charge thresholds and a corresponding plurality of unique increment values", which are described and detailed with reference to Figs. 8 and 9, and Paras. 0047, 0048, 0052 and 0055. The extreme regions are described in terms of high and low SOC regions, with example ranges given at SOC > 93.5% for the high SOC region, and SOC < 6.5% for the low SOC region. (*See,* Paras. 0044, 0045.) The corresponding unique increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge, described in Para. 0047, below:

> [0047] In accordance with a preferred implementation with respect to a high SOC, there are three different SOC diagnostic threshold levels and three different counter increment levels corresponding thereto. These different thresholds are in place to allow sufficient opportunity for the propulsion control system to take corrective action in the event an incipient threat to battery condition initiated the diagnostic yet allow the vehicle to continue to operate. In the case of a high SOC, the higher the SOC rises the larger the diagnostic counter increment. For example, if the SOC has violated a first SOC diagnostic threshold then the diagnostic counter increment will be a <u>first counter increment X</u> counts every software loop. Whereas, if the SOC has violated a second, higher, SOC diagnostic threshold, then the diagnostic counter increment will be a <u>second, larger, counter increment Y</u> counts every software loop. And, if the SOC has violated a third, even higher, SOC diagnostic threshold, then

the diagnostic counter increment will be a third, even larger, counter increment Z counts every software loop. The diagnostic counter will continue to increment as long as the SOC violated the lowest of the SOC diagnostic thresholds.

In contrast, *Koo* teaches different subregions within a universal SOC region which ranges from 0% to 100%. A battery management system applies controls to maintain a suitable state of change and manage the SOC of the battery. (*See,* Col. 4, Lines 30-34). In order to manage the SOC of the battery, various classifications of the SOC are made, including SOC state set to a Very High state when SOC is maintained above 80%, and set to a Very Low state when SOC is maintained below 25%. (*See,* Col. 4, Lines 47-56). The battery management system "resets" the state of charge of the battery to the predetermined levels based upon various algorithms. (*See,* Col. 4, Lines 57-65). There are no associated thresholds.

Koo neither teaches nor describes a predefined extreme range of state of charge comprising extreme low SOC and extreme high SOC regions, having a plurality of state of charge thresholds, as claimed in the instant invention. This alone distinguishes the instant invention of claim 7 from *Koo.*

Furthermore, and with reference to the previous argument, since *Koo* neither teaches nor describes a predefined extreme range of state of charge having a plurality of state of charge thresholds, then *Koo* fails to teach or describe "said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge". This alone distinguishes the instant invention of claim 7 from *Koo.*

Finally, *Koo* neither teaches nor describes a corresponding plurality of unique increment values, as claimed in the instant invention. This alone distinguishes the instant invention of claim 7 from *Koo.*

Furthermore, as argued previously with regard to claim 1, the SOC term of *Koo* does not anticipate the SOC of the instant invention. This alone distinguishes the instant invention of claim 7 from *Koo.*

PAGE 14/19 * RCVD AT 6/30/2006 10:13:31 AM [Eastern Daylight Time] * SVR:USPTO-EFXRF-3/7 * DNIS:2738300 * CSID:2486762799 * DURATION (mm-ss):06-36

C.5 Arguments with regard to claims 8 and 9

Claims 8 and 9 are ultimately dependent upon claim 7, and are therefore allowable for the same reasons set forth for claim 7.

Summary and Conclusion

In summary, the reference of *Koo* fails to disclose, teach, or suggest the claimed subject matter of the Applicant's invention. Therefore, claims 1-4 and 7-9 are patentable over *Koo*, and applicants respectfully request that this Panel withdraw all anticipation rejections and direct the examiner to allow all claims to proceed to issue.

Respectfully submitted,

CICHOSZ & CICHOSZ PLLC

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248.676.9095

VIII. Claims Appendix

Listing of Claims

1. (original) Method for diagnosing a critical state of charge condition of an energy storage system, comprising:

obtaining power flow and state of charge for the energy storage system;

determining if the combination of power flow and state of charge meet predetermined criteria;

if the predetermined criteria are met, indicating a critical state of charge condition if the state of charge is outside of a predetermined region of state of charge for a predetermined duration.

2. (original) Method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 1 wherein the predetermined criteria are characterized by increasingly less tolerance for charge power flow at increasingly higher state of charge.

3. (original) Method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 1 wherein the predetermined criteria are characterized by increasingly less tolerance for discharge power flow at increasingly lower state of charge.

4. (original) The method for monitoring an energy storage system state of charge as claimed in claim 1 wherein the predetermined duration is a function of the state of charge that generally decreases as the state of charge trends away from the predetermined region of state of charge and generally increases as the state of charge trends toward the predetermined region of state of charge.

5. (original) Method for diagnosing a critical state of charge condition of an energy storage system, comprising:

establishing charge and discharge thresholds for the energy storage system as a function of state of charge within predetermined regions of extreme high and low state of charge, respectively;

obtaining energy storage system power and state of charge;

comparing the energy storage system power to the appropriate one of the charge and discharge thresholds after the state of charge enters one of the predetermined regions of high and low state of charge from an intermediate region of state of charge;

if the energy storage system power violates the appropriate one of the charge and discharge thresholds while the state of charge is within the one of the predetermined regions of high and low state of charge, monitoring the duration that the state of charge remains within the one of the predetermined regions of high and low state of charge; and,

if the duration exceeds a predetermined duration, providing an indication of a critical state of charge condition.

6. (original) The method for monitoring an energy storage system state of charge as claimed in claim 5 wherein the predetermined duration is a function of the state of charge that generally decreases as the state of charge moves away from the intermediate region of state of charge and generally increases as the state of charge moves toward the intermediate region of state of charge.

7. (original) Method for diagnosing a critical state of charge condition of an energy storage system, comprising:

within a predefined extreme range of state of charge, providing a plurality of state of charge thresholds and a corresponding plurality of unique increment values, said increment values being larger the further away the corresponding state of charge threshold is from a predefined non-extreme range of state of charge;

periodically obtaining state of charge;

for so long as state of charge is outside of the predefined range of non-extreme state of charge

comparing the state of charge to the state of charge thresholds and selecting one of said increments in accord with the comparison;

incrementing a counter with the selected increment;

comparing the counter to a counter limit; and

providing an indication of a critical state of charge condition if said counter exceeds said counter limit.

8. (original) The method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 7 wherein the predefined extreme range of state of charge corresponds to high state of charge.

9. (original) The method for diagnosing a critical state of charge condition of an energy storage system as claimed in claim 7 wherein the predefined extreme range of state of charge corresponds to low state of charge.

IX. Evidence Appendix

No additional evidence is being submitted.

X. Related Proceedings Appendix

There are no related proceedings.